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ABSTRACT

Since it became a reality just before World War II, terrestrial microwave has improved in systems and equipments, but with the improvements have come higher costs. Television microwave costs are so high because users are demanding more capability, land prices have increased, operating costs are higher, and there is frequency congestion along many systems. The rate for television microwave service may be as low as $27.50 per mile for the so-called "ETV Tariff," or as high as $90.00 per mile for the tariff 260 used by most commercial stations and networks. There are instances where the television broadcaster or system user can do his own microwave portions to his advantage, but this is not true in all situations. When microwave needs get to multiple channels, several relays, or requires special performance conditions, the user should consider leasing the service from qualified carriers rather than attempting to do it himself. The user can minimize his costs by acquainting himself with the possibilities and by making wise choices. (MF)

TELEVISION MICROWAVE - 1971

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With all the glamour and promise of satellite communications, the success of instruction by television, and the challenge of social needs, we need to temper and balance our outlook at times with the reality of today and our progress from yesterday. The communications field is now so broad, the sophistication and capability is advancing so fast, we can easily forget that methods, techniques and operating procedures of only a few years ago may well be obsolete and impractical today.

Terrestrial microwave became a reality just before World War II with hardware that would be barely recognizable today. Yet this means of communications has advanced steadily and with relative quiet over the years. Users of microwave service have allowed their concept of the service to become fixed to what may have been available when they first needed the service. Terrestrial microwave has evolved, improved, and changed steadily over the years. Communication managers and engineers must keep current with the capabilities and realities of microwave.

To help visualize the recent changes, consider this: As little as ten years ago, most of the better microwave equipments were still tube type, requiring large amounts of AC power, constant servicing, and considerable space. Today's equipment is virtually all solid state, of greater sensitivity and stability, and needs only a fraction of the space. Power requirements are sharply reduced, now making it routinely practical to use DC batteries on floating charge to eliminate most failures from prime power outages.

Consider further that equipments of ten years ago had a power output of 0.1 watt to 1.0 watt. Antennas were less efficient and sizes larger than six feet were virtually unknown. Receivers were typically insensitive and unstable, all to the frustration of the system user. Today, microwave transmitters are available with 20 watts of power. Ten and twelve feet diameter antennas are readily available, and a variety of new horn antennas are making their appearance.

Receiving equipments have vastly improved filters and amplifiers to permit more linear and noise free operation. The biggest indication of receiver improvements is in the system capability. To use a rough approximation, one television signal with its associated sound carrier is equivalent to about 600 voice channels on a microwave carrier. Although the actual signals are quite different, a microwave RF system could, if properly designed and operated, accommodate either kind of input without significant impairment of the output. The system of ten to fifteen years ago were largely of this sort, and many are still in service today.

The advent of solid state and more sophisticated circuitry has brought new capabilities to microwave equipments. Today's equipments and systems frequently are capable of 1200 voice channels, and some are even capable of handling up to 1800 voice channels. Sad to say however, this doesn't mean two or three TV signals on a single RF carrier. Although this may be possible someday, present hardware doesn't permit this yet. The higher capacity systems of today do allow far better TV transmissions that ever before and have the capacity for some voice or radio line service as well. A high quality microwave system for TV should be virtually transparent, adding no significant deterioration to the picture signals.

Why Does Microwave Cost So Much.

With all this improvement in systems and equipments, why does it cost so much for a TV microwave system? AT&T Long Lines has a tariff of nearly $90.00 a mile per month plus local loops charges of $3,800 per month at each end. Is this a reasonable charge for service? What about the old "ETV Tariff"? Isn't this still available? What about the miscellaneous common carriers? Can't a private or self owned system do the job for less? Unfortunately, there is no simple clear answer to any of these questions. But let's put a little more light on them to gain a better perspective.

Microwave Users Are Demanding More Capability.

First, let's recognize that microwave has come a long way in the last ten to fifteen years. The technical improvements in both the hardware and the

system design have made many older systems uneconomic or incapable of meeting today's demand for service. Tube type, 0.1 watt, TV remodulating microwave has been on the junk heap for several years now because it was never designed for color and could not readily accommodate it except on very short paths. Color TV (and all communications) has become more complex and demanding on its total transmission system. The microwave hardware portions have had to make major improvements to satisfy these higher levels of performance, and this has rightfully added a degree of extra cost.

Fixed Costs Have Risen.

Second, the fixed costs of a microwave system have jumped substantially in recent years. Land prices have increased. Sometimes we manage to obtain land only to find AC power must be brought in from many miles away - - underground! At other times, even the local towns seem against us when near extortion prices are demanded for road and power line easements and building permits. Road and construction contractors have to pay higher labor rates, equipment costs, etc., so their charges are higher. Just about everything that goes into a microwave relay site is more costly today than fifteen years ago.

Operating Costs Are Higher.

The third reason microwave costs are higher today is inherent in the operation of a complex system. Carriers have to keep up with prevailing labor rates, then expend added amounts to train or retrain its personnel to be proficient in the new complexities of the system of microwave. The technician must be continually upgraded through improved skills and efficiency. The rapid evolution of equipments has literally demanded this of the technician. Supervisory personnel must keep up with the technical changes, and must be constantly aware of subtle but significant improvements in operating practices. Of course, management finds its abilities taxed to the limit with many more diverse and complex demands being made upon it. Simply stated, when any business activity becomes larger, more diversified and complex, its operating costs increase also.

Frequency Congestion.

The fourth reason microwave costs are higher today is the congestion along many systems. Because the frequency spectrum for microwave is finite, each user of a specific frequency must take increasing pains to minimize the potential of interference to and from other microwave uses on the same or adjacent frequencies. Larger antennas, careful routing and more accurate frequency control sound rather simple but each one can add many thousands of dollars to the cost of a system. It is not uncommon to have to use costly high performance antennas and expensive sites because potential interference must be eliminated before a system will be constructed or expanded. Rerouting a system can add extra relay sites. A high quality system costs more than $100,000.00 for each site, so extra relays add up fast.

Telephone Carriers.

The Telephone carriers including AT&T Long Lines offers and continues to provide TV microwave service at a variety of tariffs. These range from the low of $27.50 per mile for the so called "ETV Tariff" to the recently revised tariff 260 used by most commercial stations and networks at a cost of nearly $90.00 per mile plus $3800 for each terminal per month. (18 hours per day) No attempt is made here to justify the extremes of these tariffs. We can only make the assumption that the tariffs still reflect a reasonable rate of return for the specific services provided. The lower rate supposably is a pretty minimum type of service, not corrected for color, having limited audio response, and outages corrected only after notice of failure by the customer.

The commercial rates of tariff 260 cover a service that is admittedly pretty good. Its performance and reliability for color TV are a definite challenge to other microwave common carriers. Full time monitoring, route and channel diversity, and company resources in plant and manpower are believed largely responsible for the performance, reliability and cost.

Miscellaneous Carriers.

Most non-telephone communications common carriers have tariff rates for TV transmission service lower in price than the telephone carriers. But the lower tariff does not imply cut rate prices. Miscellaneous carriers attempt to provide specialized service in regional areas where the larger telephone carriers find it impractical or uneconomic to provide such service. Regardless of the specific tariff charge, any carrier must show a reasonable rate of return for the service provided. Less cost, less service. However, because most miscellaneous carriers are relatively small in size, they are likely to be more flexible in operation, quicker to adapt to changes and because they have generally lower overhead, their comparable service offerings tend to be somewhat lower in cost.

Special Service Offerings.

All communications common carriers can provide special service offerings. This is simply a one time only tariff for a specific unique service and area. Usually this approach to establishing a fair price for the service is used when the specific needs and requirements of the microwave system do not fit any tariff offering. The customer must prepare complete specifications of performance and operation for the system and the carrier then provides the service at a tariff or price directly related to its projected cost.

When a new category or type of service appears to have considerable demand, but the carrier cannot reasonably judge the actual cost of the service, an experimental or developmental tariff may be used which allows considerable adaptability to the customer needs. Some carriers have extended a developmental tariff over a number of years before putting it out as a regular service offering.

Do It Yourself.

The question frequently arises "Can't I install this microwave system myself and save lots of cost?" I won't brush this question off lightly, because there are instances where the TV broadcaster or system user can do

his own microwave portions to his advantage. But remember it doesn't apply to all situations. There are instances where leasing the service is more expedient, fits better with funds available, and permits the system user to concentrate on its primary concern of TV programing, without becoming a massive technical organization a well.

The TV station, ITFS system, or even a campus closed circuit system of modest size probably should at least consider doing its own local microwave service if they have available technical manpower. At least two persons should be thoroughly familiar with microwave techniques to cover each other at all times. As long as the system remains simple such as an STL, or a remote pickup unit, no complex problems are likely to occur. However, multi-hop systems present different and often complicated problems that are well beyond the capability of most station maintenance personnel.

When microwave needs get to multiple channels, several relays (hops) or requires special performance conditions, the user should consider leasing the service from qualified carriers rather than attempting to do it himself. The depth of experience and overall operational capabilities that are prerequisites of any communications common carrier to survive are the very things that make complex and sophisticated communications possible.

The User Can Help Keep Costs Reasonable.

Realizing that microwave costs more today than ten or fifteen years ago, lets get specific on how to keep the costs as reasonable as possible. I would like to suggest seven ways to be sure you are getting your money's worth in microwave communications.

1. Know what transmission services you really need. Weed out wishful thinking and capabilities that are ten or more years away from being needed. In essence, stay with requirements that can be clearly and reasonably predicted.
2. Get outside impartial help to plan and guide your present and future transmission services. Frequently the user is too close to his problems to see clearly and objectively the best solutions.

3. Be sure you incorporate a reasonable time to implement a new service or system. Expansion of an existing system needs eight to twelve months. Eighteen months is a pretty reasonable time for design and construction of an all new system, even when things go smoothly. Bad weather, strikes, legal entanglements, etc., all can add many months.

4. Shop around for the services. Today, with television microwave, there are usually several carriers who can provide the service. Unless the system is very large, however, only locally based carriers are likely to be both competitive in price and able to provide good reliable service.

5. To put your own mind at ease, get a realistic cost estimate of doing the system yourself. But a word of caution, be careful to put in <u>all</u> costs, including those of money, of personnel improvement (and raises), test equipment, travel for maintenance, taxes, and even eventual replacement of many equipment items. If you have done your homework, a typical two-way high quality heterodyne repeater for television will have a capital cost, including installation, of $85,000 or more, each!

6. Don't underestimate the "people problem". A new system or even a new service on an existing system will require people who are expert and experienced. These people can neither be purchased nor trained overnight, and both are expensive. Endeavor to keep your system and personnel requirements at levels that can be justified by the service to be performed.

7. Lastly, choose wisely.

I don't promise you cut rate or bargain microwave service with these suggestions. But I would hope that you will get the service you need at a price that is reasonable. Bargain rates today become poor service and headaches tomorrow. Buy the services you need and expect to pay a fair price for them. The carrier can then continue to provide good service and he will be better able to adapt to your changing needs when they occur.